1. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 25x^3 + 75x^2 - 16x - 48$$

A. $z_1 \in [-3.16, -2.71]$, $z_2 \in [-1.32, -1.21]$, and $z_3 \in [1.09, 1.63]$

B. $z_1 \in [-1.28, -1.18]$, $z_2 \in [1.09, 1.35]$, and $z_3 \in [2.81, 3.32]$

C. $z_1 \in [-3.16, -2.71]$, $z_2 \in [-0.86, -0.49]$, and $z_3 \in [0.52, 0.91]$

D. $z_1 \in [-4.08, -3.92]$, $z_2 \in [0.08, 0.21]$, and $z_3 \in [2.81, 3.32]$

E. $z_1 \in [-0.9, -0.7]$, $z_2 \in [0.52, 0.96]$, and $z_3 \in [2.81, 3.32]$

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2. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{20x^3 - 106x^2 + 112x - 30}{x - 4}$$

A. $a \in [79, 82]$, $b \in [-426, -424]$, $c \in [1811, 1818]$, and $r \in [-7295, -7290]$.

B. $a \in [79, 82]$, $b \in [212, 216]$, $c \in [965, 973]$, and $r \in [3836, 3844]$.

C. $a \in [17, 26]$, $b \in [-47, -44]$, $c \in [-27, -22]$, and $r \in [-109, -104]$.

D. $a \in [17, 26]$, $b \in [-28, -23]$, $c \in [4, 11]$, and $r \in [-1, 5]$.

E. $a \in [17, 26]$, $b \in [-192, -184]$, $c \in [855, 861]$, and $r \in [-3457, -3450]$.

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3. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{6x^3 + 28x^2 - 68}{x + 4}$$

A. $a \in [-27, -23], b \in [123, 125], c \in [-498, -495]$, and $r \in [1913, 1919]$.

B. $a \in [3, 9], b \in [4, 9], c \in [-19, -11]$, and $r \in [-5, -3]$.

C. $a \in [-27, -23], b \in [-68, -63], c \in [-277, -267]$, and $r \in [-1157, -1153]$.

D. $a \in [3, 9], b \in [51, 53], c \in [208, 211],$ and $r \in [762, 767]$.

E. $a \in [3, 9], b \in [-6, 1], c \in [4, 15],$ and $r \in [-125, -117]$.

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4. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 10x^3 - 21x^2 - 135x - 50$$

A. $z_1 \in [-4.5, -1.5],\ z_2 \in [-0.52, -0.38],$ and $z_3 \in [5, 7]$

B. $z_1 \in [-4.5, -1.5],\ z_2 \in [-0.52, -0.38],$ and $z_3 \in [5, 7]$

C. $z_1 \in [-6, -4],\ z_2 \in [0.36, 0.46],$ and $z_3 \in [1.5, 4.5]$

D. $z_1 \in [-6, -4],\ z_2 \in [0.01, 0.37],$ and $z_3 \in [5, 7]$

E. $z_1 \in [-6, -4],\ z_2 \in [0.36, 0.46],$ and $z_3 \in [1.5, 4.5]$

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5. Factor the polynomial below completely, knowing that $x - 3$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 9x^4 + 9x^3 - 163x^2 + 115x + 150$$

A. $z_1 \in [-5.2, -4.7],\ z_2 \in [-1.62, -1.48], z_3 \in [0.52, 0.63],$ and $z_4 \in [2.4, 3.2]$

B. $z_1 \in [-5.2, -4.7],\ z_2 \in [-3.05, -2.99], z_3 \in [0.12, 0.28],$ and $z_4 \in [4, 5.3]$

C. $z_1 \in [-3.7, -2],\ z_2 \in [-0.65, -0.6], z_3 \in [1.47, 1.5],$ and $z_4 \in [4, 5.3]$

D. $z_1 \in [-5.2, -4.7],\ z_2 \in [-0.74, -0.64], z_3 \in [1.64, 1.74],$ and $z_4 \in [2.4, 3.2]$

E. $z_1 \in [-3.7, -2],\ z_2 \in [-1.71, -1.63], z_3 \in [0.66, 0.71],$ and $z_4 \in [4, 5.3]$

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 + 26x^2 - 68x - 53}{x + 4}$$

A. $a \in [-42, -33]$, $b \in [-134, -130]$, $c \in [-607, -603]$, and $r \in [-2473, -2463]$.

B. $a \in [-42, -33]$, $b \in [185, 188]$, $c \in [-818, -809]$, and $r \in [3195, 3197]$.

C. $a \in [9, 11]$, $b \in [-30, -21]$, $c \in [52, 57]$, and $r \in [-321, -310]$.

D. $a \in [9, 11]$, $b \in [-16, -13]$, $c \in [-14, -10]$, and $r \in [-8, -1]$.

E. $a \in [9, 11]$, $b \in [66, 70]$, $c \in [196, 202]$, and $r \in [722, 739]$.

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7. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{6x^3 + 28x^2 - 62}{x + 4}$$

A. $a \in [4, 10], b \in [51, 53], c \in [207, 212]$, and $r \in [762, 773]$.

B. $a \in [4, 10], b \in [-6, 1], c \in [8, 13]$, and $r \in [-115, -105]$.

C. $a \in [-25, -21], b \in [120, 125], c \in [-503, -493]$, and $r \in [1917, 1926]$.

D. $a \in [4, 10], b \in [3, 8], c \in [-17, -14]$, and $r \in [2, 3]$.

E. $a \in [-25, -21], b \in [-72, -65], c \in [-277, -268]$, and $r \in [-1150, -1148]$.

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8. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 6x^2 + 2x + 3$$

A. $\pm 1, \pm 3$

B. $\pm 1, \pm 2, \pm 3, \pm 6$

C. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 2, \pm 3, \pm 6}$

D. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 3}$

E. There is no formula or theorem that tells us all possible Integer roots.

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9. Factor the polynomial below completely, knowing that $x-3$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^4 - 90x^3 + 343x^2 - 510x + 225$$

A. $z_1 \in [-5.86, -4.88]$, $z_2 \in [-3.65, -2.93]$, $z_3 \in [-3.38, -2.77]$, and $z_4 \in [-0.71, -0.43]$

B. $z_1 \in [-5.86, -4.88]$, $z_2 \in [-3.65, -2.93]$, $z_3 \in [-2.14, -0.63]$, and $z_4 \in [-0.49, -0.24]$

C. $z_1 \in [-5.86, -4.88]$, $z_2 \in [-3.65, -2.93]$, $z_3 \in [-2.84, -2.19]$, and $z_4 \in [-0.83, -0.74]$

D. $z_1 \in [0.6, 0.85]$, $z_2 \in [2.02, 3.75]$, $z_3 \in [2.3, 3.15]$, and $z_4 \in [4.99, 5.07]$

E. $z_1 \in [0.14, 0.74]$, $z_2 \in [1.06, 1.46]$, $z_3 \in [2.3, 3.15]$, and $z_4 \in [4.99, 5.07]$

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10. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 7x^3 + 5x^2 + 2x + 5$$

A. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 5}$

B. $\pm 1, \pm 7$

C. $\pm 1, \pm 5$

D. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 7}$

E. There is no formula or theorem that tells us all possible Rational roots.
